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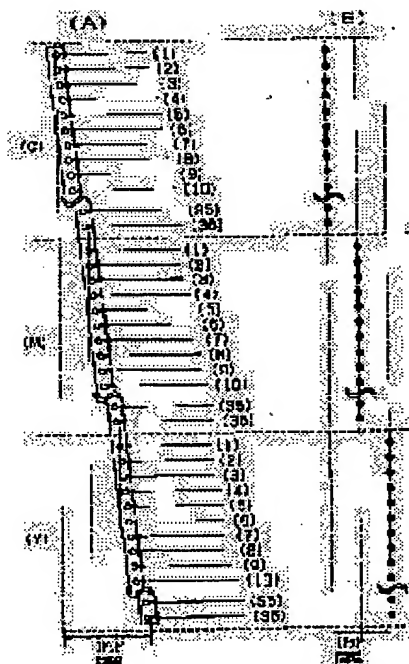
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(54) INK JET RECORDER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an ink jet recorder generating no difference in level even if block driving is performed, capable of obtaining good linearity and enabling a high speed printing.

SOLUTION: A C, M and Y integrated type ink jet printing head is used to form blocks at every colors and the respective blocks are successively driven. The gaps between the respective blocks drive nozzles at the corresponding positions at the same time. At this time, the positions of the corresponding nozzles between adjacent blocks are spaced apart from each other in a scanning direction by one dot interval of recording resolving power. By this constitution, the number of blocks required in one printing operation of the ink jet printing head becomes a 1/number of blocks to enable high speed printing. The linearity in each of the blocks is enhanced by successive driving.



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CLAIMS

[Claim(s)]

[Claim 1] In the ink jet recording device which has the ink jet print head which has two or more nozzles, and the actuation control means which drives said nozzle said control means By said nozzle which divides said two or more nozzles into two or more blocks, drives simultaneously about a whole block at the time of 1 of each block, or actuation of said two or more nozzles, and is in the corresponding physical relationship in an adjoining block The ink jet recording device characterized by forming a dot in the location from which only 1 dot space of record resolution was separated to the scanning direction.

[Claim 2] In the ink jet recording device which has the carriage which moves in the direction of a form feed in the direction which carries out an abbreviation rectangular cross, the ink jet print head which has two or more nozzles, and the actuation control means which drives said nozzle Said control means divides said two or more nozzles into two or more blocks, and drives simultaneously 1 or two or more nozzles of each block. Said ink jet print head The ink jet recording device characterized by leaning to the migration direction of said carriage, and the direction which intersects perpendicularly, and equipping said carriage so that the distance between each nozzle to which said adjoining block corresponds may serve as 1 dot space of record resolution in the migration direction of said carriage.

[Claim 3] It is the ink jet recording device according to claim 1 or 2 which said ink jet print head can record the color material of two or more colors, and is characterized by said block being a different color-material unit.

[Claim 4] Said control means is an ink jet recording device according to claim 1 or 2 characterized by driving two or more [every / 1 or] so that said nozzle which adjoins within said each block may not be made to inject simultaneously.

[Claim 5] Said control means is an ink jet recording device according to claim 1 or 2 characterized by making it dispersed so that the regurgitation of the nozzle which adjoins the regurgitation sequence within said each block may not be carried out continuously.

[Claim 6] Said control means is an ink jet recording device according to claim 1 or 2 characterized by dividing said each block into a still smaller subblock, driving two or more [every / 1 or] so that said nozzle which adjoins within said subblock may not be made to inject simultaneously, and making each subblock applicable to sequential actuation.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention makes ink breathe out from a nozzle, and relates to the ink jet recording device which records on a recorded material by making an ink dot adhere.

[0002]

[Description of the Prior Art] The improvement in a regurgitation frequency which makes ink breathe out from a nozzle, and many nozzle-ization to which the number of nozzles is made to increase further are needed as high-resolution-izing of an ink jet recording device and high-speed record-ization progress in recent years. In the ink jet recording device which has the ink jet print head equipped with many nozzles, in order to drive all nozzles simultaneously, a big current is required, since a power unit etc. is enlarged, it divides into a block for some of every nozzles, and the block actuation driven for every block is made.

[0003] Drawing 9 is the explanatory view of an example of the conventional actuation approach. In the example shown in drawing 9, the nozzle within each block is driven simultaneously, using four nozzles as 1 block, and sequential actuation of each block is carried out, and it is. Since the number of the nozzles simultaneously driven by this is four, they can reduce the power supply of a power unit substantially.

[0004] Of such actuation, as shown in a recorded material on the right-hand side of drawing 9 (A), the dot train which shifted 4 dots at a time little by little is formed. The way things stand, in order that the straight line of an image may incline, as usually shown in drawing 9 (B), a little ink jet head is leaned, arranged and amended. Or it constitutes so that the adjoining nozzle may not serve as the same block, and there are some which tended to be made to distribute a dot train and were going to raise linearity as indicated by JP,5-220988,A. Furthermore, in JP,7-96607,A, linearity is raised by overlapping a part of injection field and driving. However, it has the fault that an actuation control circuit becomes complicated [such an actuation approach], and the time amount to the completion of injection becomes long.

[0005] Moreover, in the ink jet print head equipped with many nozzles, if ink is injected from a certain nozzle, the pressure fluctuation in a nozzle and floating of ink will occur in the case of injection of ink. This pressure fluctuation and floating of ink may spread for other nozzles, and may cause the acoustical cross talk like a fluid. That is, with each nozzle, in response to the effect of an acoustical cross talk like a fluid from the nozzle which injected previously, disturbance is produced at the time of injection, consequently image quality defects, such as abnormalities in a satellite, may be caused.

[0006] For this reason, the method of avoiding disturbance by separating as physically as possible the

nozzle which injects to the following timing which is the easiest to be influenced from the nozzle which injected ink has been taken. However, detaching distance too much spoiled the linearity on an image from the gap of printing timing, and the electric actuation approach not only becomes difficult, but it had a problem of it becoming impossible to maintain the image quality of high quality.

[0007] For example, in JP,7-81066,A, the adjoining nozzle is driven continuously. Therefore, a cross talk occurs between the adjoining nozzles and there is a problem that an image deteriorates. Moreover, above-mentioned JP,5-220988,A and above-mentioned JP,7-96607,A are also driven to the timing which the adjoining nozzle follows, a cross talk occurs too and degradation of image quality is produced.

[0008] Such a cross talk is avoided and interlace is proposed as the actuation approach which raises drive frequency. Drawing 10 is the explanatory view of an example of the actuation approach of the conventional interlace. Drawing 10 shows the example which drives eight nozzles in 8 steps. At interlace, when a certain nozzle drives, the nozzle left if possible is driven to the following timing. In this example, after driving the 1st nozzle, the 5th nozzle is driven and it drives hereafter in the 3rd, the 7th, the 2nd, the 6th, the 4th, and the 8th order. Since the nozzle which adjoins to the timing which continues by performing such actuation does not drive, it is hard to generate and a cross talk can maintain good image quality. Moreover, although a certain extent spreads to a certain width of face in the recorded dot, linearity improves.

[0009] In applying such interlace to the ink jet print head which has many nozzles, it does not perform usually carrying out sequential actuation of every one of all nozzles, but it divides into a group for every number of a certain, and drives by interlace within each group. And it drives one nozzle of each group at a time simultaneously from relation, such as a power supply, by considering the group of only the number of nozzles which can be driven as a block. What is necessary is just to carry out sequential actuation of each block.

[0010] On the other hand, two or more nozzles arranged by one head are divided into the color number, and the ink jet print head which can record two or more colors is developed. Such an ink jet print head is indicated by JP,2-204053,A etc. However, in the ink jet print head indicated by this reference, since the nozzle which injects a different color material adjoins, there are problems, such as color mixture. In JP,4-263949,A, spacing of the nozzle which injects a different color material was made large, and color mixture etc. is prevented. Furthermore, in JP,5-138884,A, it has prepared between the nozzles which inject color material which is different in a dummy nozzle. A dummy nozzle is a nozzle which is not used at the time of actual record actuation, and has realized stabilization of injection.

[0011] In the ink jet print head of such two or more color one apparatus, the case where actuation by the above interlace is performed is considered. Drawing 11 is the explanatory view of the level difference at the time of driving interlace in the ink jet print head of two or more color one apparatus. The ink jet print head of cyanogen (C), a Magenta (M), and 3 color one apparatus of yellow (Y) is shown in drawing 11 (A). In addition, the graphic display of each nozzle is omitted. It considers dividing such an ink jet print head into four blocks, and carrying out sequential actuation. Since the inside of each block is driven by interlace, as shown in drawing 10, a dot is distributed and recorded in a certain width of face d. In case actuation of one block is completed and the following block is driven, a dot will be recorded on the field of width of face d to which only the width of face d recorded by previous block as shown in drawing 11 (B) shifted.

[0012] When the nozzle which adjoined as shown in drawing 9 was simultaneously driven as a block and

sequential actuation of each block was carried out, gap of each dot was minute and it was only that gap arises as a whole, but in this interlace, as shown in drawing 11 (B), the amount of gaps during a block becomes large. The gap during this block serves as a visual level difference, and reduces image quality. In the block which mainly records an alphabetic character in many cases, this visual level difference did not become a problem so much, but had mainly become a problem in many [in the cases of mainly recording graphic patterns, such as a chart,] of other colors. When a block as shown in drawing 11 (A) is divided, the boundary of a block may exist and a visual level difference may produce all three colors in the boundary part of this block.

[0013]

[Problem(s) to be Solved by the Invention] This invention aims at offering the ink jet recording device which enabled high-speed printing while it was made in view of the situation mentioned above, a level difference is not produced even if it performs block actuation, but good linearity is acquired.

[0014]

[Means for Solving the Problem] In the ink jet recording device which has the ink jet print head in which invention according to claim 1 has two or more nozzles, and the actuation control means which drives said nozzle Said control means divides said two or more nozzles into two or more blocks, and drives them simultaneously about a whole block at the time of 1 of each block, or actuation of said two or more nozzles. It is characterized by forming a dot in the location from which only 1 dot space of record resolution was separated to the scanning direction by said nozzle in the corresponding physical relationship in an adjoining block.

[0015] The carriage which invention according to claim 2 moves in the direction of a form feed in an ink jet recording apparatus in the direction which carries out an abbreviation rectangular cross, In the ink jet recording device which has the ink jet print head which has two or more nozzles, and the actuation control means which drives said nozzle said control means Said two or more nozzles are divided into two or more blocks, and 1 or two or more nozzles of each block are driven simultaneously. Said ink jet print head It is characterized by leaning to the migration direction of said carriage, and the direction which intersects perpendicularly, and equipping said carriage so that the distance between each nozzle to which said adjoining block corresponds may serve as 1 dot space of record resolution in the migration direction of said carriage.

[0016] As for said ink jet print head, invention according to claim 3 can record the color material of two or more colors in an ink jet recording apparatus according to claim 1 or 2, and it is characterized by said block being a different color-material unit.

[0017] Invention according to claim 4 is characterized by driving said control means two or more [every / 1 or] so that said nozzle which adjoins within said each block may not be made to inject simultaneously in an ink jet recording apparatus according to claim 1 or 2.

[0018] Invention according to claim 5 is characterized by dispersing said control means so that the regurgitation of the nozzle which adjoins the regurgitation sequence within said each block may not be carried out continuously in an ink jet recording apparatus according to claim 1 or 2.

[0019] It is characterized by for said control means dividing said each block into a still smaller subblock, for invention according to claim 6 driving it two or more [every / 1 or] so that said nozzle which adjoins within said subblock may not be made to inject simultaneously, and making each subblock applicable to sequential actuation in an ink jet recording apparatus according to claim 1 or 2.

[0020]

[Embodiment of the Invention] Drawing 1 is the outline configuration perspective view showing an example of the ink jet print head used in one gestalt of operation of the ink jet recording apparatus of this invention, drawing 1 (A) shows an example of a monochromatic ink jet print head, and drawing 1 (B) shows an example of the ink jet print head of 3 color one apparatus. Moreover, similarly drawing 2 is the sectional view of the direction of passage. the inside of drawing, and 1 -- a channel substrate and 2 -- a heater substrate and 3 -- for a reservoir septum and 6, as for a dummy nozzle and 8, the nozzle for printing record and 7 are [a thick-film resin layer and 4 / an ink reservoir and 5 / spacing and 9] heating elements.

[0021] Two or more ink passage and ink reservoirs 4 are formed in the channel substrate 1. The ink reservoir 4 is formed for every ink of each color. Three ink reservoirs 4 are formed in the ink jet print head of 3 color one apparatus shown in drawing 1 (B). In this case, three colors of yellow (Y), a Magenta (M), and cyanogen (C) can be used as ink. Each ink reservoir 4 is separated by the reservoir septum 5. Moreover, one ink reservoir 4 is formed in the ink jet print head shown in drawing 1 (A). For example, the ink of black (K) can be used. In addition, the ink reservoir 4 penetrates the channel substrate 1, and is formed, and the ink of each color is supplied from this breakthrough.

[0022] Moreover, two or more ink passage is established in the channel substrate 1, and it is open for free passage to the ink reservoir 4. In the ink jet print head of 3 color one apparatus shown in drawing 1 (B), two or more ink passage is formed corresponding to each color, and is open for free passage to the ink reservoir 4 which corresponds, respectively. Ink passage is prepared every 63.5 micrometers with the recording density of for example, 400DPI. All over ink passage, as shown in drawing 2, the heating element 9 is formed, and it drives by the actuation control section mentioned later, and generates heat, air bubbles are grown up into ink, and ink is made to breathe out from a nozzle with the pressure of air bubbles. 1 thru/or two or more ink passage of ends is used as a dummy nozzle 7 among two or more ink passage connected to each ink reservoir 4, and others are used as a nozzle 6 for printing record. That is, in case printing record is performed, it is carried out only using the nozzle 6 for printing record.

[0023] With the nozzle near the side face of the ink reservoir 4, the regurgitation of ink tends to become instability as indicated by above-mentioned JP,5-138884,A. Therefore, the dummy nozzle 7 is not used at the time of printing record. However, the dummy nozzle 7 is possible for carrying out the regurgitation of the ink. For example, ink can be made to be able to breathe out at the time of a maintenance, or ink can be attracted also from the dummy nozzle 7 by priming actuation. Air bubbles, dust, etc. which pile up near the side face of the ink reservoir 4 are discharged with ink from the dummy nozzle 7 by this outside, and can mitigate the poor regurgitation at the time of printing record by it.

[0024] At the ink jet print head of 3 color one apparatus shown in drawing 1 (B), spacing 8 is formed between the dummy nozzles 7 which a different color adjoins in the same pitch as the pitch of the nozzle 6 for printing record, and the dummy nozzle 7. This spacing 8 can be made only into spacing which can arrange several nozzles. Between the nozzles 6 for printing record which carry out the regurgitation of the ink of a different color at the time of printing record, this spacing 8 and spacing of the dummy nozzle 7 will be vacant. The color mixture of the ink of the color which changes with these can be reduced, and good image quality can be acquired. Moreover, the work which controls surroundings ***** of the adhesives at the time of pasting up the channel substrate 1 and the heater substrate 2 also has the dummy nozzle 7.

[0025] On the other hand, corresponding to the nozzle 6 for printing record, and the dummy nozzle 7, a heating element 9 is formed in the heater substrate 2, an electrode, a protective coat, etc. are formed in it, and the thick-film resin layer 3 is formed on it. The crevice which connects ink passage and the ink reservoir 4, and the crevice on a heating element are formed in the thick-film resin layer 3. And the channel substrate 1 and the heater substrate 2 are joined, it cuts by the position of ink passage, and the head chip is constituted.

[0026] Although the ink jet print head of 3 color one apparatus was shown in drawing 1 (B), in the ink jet print head which unified not only three colors but with a colors of two or more two or more colors, it can constitute similarly. Moreover, although the ink jet print head of the monochrome shown in the ink jet print head and drawing 1 (A) of 3 color one apparatus shown in drawing 1 (B) here is put side by side and used, various deformation, such as using one ink jet print head of 4 color one apparatus, is possible.

[0027] Drawing 3 is the front view showing the example of the ink jet print head used in one gestalt of operation of the ink jet recording apparatus of this invention. here -- as an example -- an ink jet print head -- 144 actuation -- it shall have a controllable heating element and the arrangement is shown about 144 nozzles which can be driven. When securing record speed, it is so desirable that there are many numbers of the nozzle which can be driven. For convenience, the sequence number will be shown from a left-hand side nozzle, and each nozzle will be shown by the number. In the ink jet print head of the monochrome shown in drawing 3 (A), black (K) shall be recorded and black (K) is injected from all 144 nozzles from No. 1 to No. 144.

[0028] The ink jet print head of 3 color one apparatus shown in drawing 3 (B) shall inject and record the ink of cyanogen (C), a Magenta (M), and yellow (Y) from the left, and is assigning 48 nozzles, respectively. 36 nozzles of No. 7-42 are used as a nozzle 6 for printing record by using six nozzles of 6 and No. 43-48 of No. 1-6 as a dummy nozzle among the nozzles from No. 1 which injects the ink of cyanogen (C) to No. 48. Moreover, 36 nozzles to No. 55-90 are used as a nozzle 6 for printing record by using six nozzles of 6 and No. 91-96 of No. 49-54 as the dummy nozzle 7 among the nozzles from No. 49 which injects the ink of a Magenta (M) to No. 96. Six nozzles of 6 and No. 139-144 of No. 97-102 are used as the dummy nozzle 7 among the nozzles from No. 97 which injects the ink of yellow (Y) to No. 144, and 36 nozzles of No. 103-138 are used as a nozzle 6 for printing record.

[0029] In addition, spacing which can arrange six nozzles is prepared as spacing 8. Although the channel substrate 1 and the heater substrate 2 are pasted up as mentioned above and an ink jet print head is assembled, it is necessary to secure magnitude to some extent as spacing 8 on manufacture. Therefore, the field of six nozzles was secured as a field of spacing 8 where the dummy nozzle between colors does not exist.

[0030] Drawing 4 is the mimetic diagram showing an example of the wearing condition of the ink jet print head in one gestalt of operation of the ink jet recording apparatus of this invention. the inside of drawing, and 11 -- for a carriage guide and 14, as for the carriage migration direction and 16, a record form and 15 are [an ink jet pudding head and 12 / carriage and 13 / the direction of a form feed and 17] actuation control sections.

[0031] Carriage 12 carries the ink jet print head 11, slides on the carriage guide 6, and moves in the carriage migration direction 15 shown by the drawing Nakaya mark. At this time, according to the actuation control by the actuation control section 17 which is mentioned later, ink is breathed out from the nozzle of the ink jet print head 11, and record is performed in the record form 14. The record form 14

moves in the direction of a form feed shown by the drawing Nakaya mark which carries out an abbreviation rectangular cross with the carriage migration direction 15.

[0032] As an ink jet print head 11 carried in carriage 12, it can consider as the ink jet print head of above-mentioned monochrome, and the ink jet print head of 3 color one apparatus. To the carriage migration direction 15 and the direction which intersects perpendicularly, these ink jet print heads 11 are leaned somewhat, and it is equipped with them so that it may mention later. In the conventional recording apparatus, all the nozzles were leaning the ink jet print head 11 in the range settled in less than one dot pitch. In this invention, for every block which is the unit which drives the nozzle prepared in the ink jet print head 11, it leans so that only one dot pitch may shift. For example, in the ink jet print head of 3 color one apparatus, it considers as a block for every color, and the ink jet print head 11 can be leaned and it can attach in carriage 12 so that only one dot pitch may shift between the adjoining colors.

[0033] The relation of the stowed position of two ink jet print heads The nozzle of No. 7 of the ink jet print head of 3 color one apparatus which the nozzle of No. 1 of the ink jet print head of the black (K) shown in drawing 3 (A) specifically showed to drawing 3 (B) is made to correspond. It can equip with the nozzle of No. 144 of the ink jet print head of the black (K) shown in drawing 3 (A) so that the nozzle of No. 138 of the ink jet print head of 3 color one apparatus shown in drawing 3 (B) may be made to correspond. As shown in the array direction of the nozzle in each ink jet print head at drawing 4 together with the direction which carries out an abbreviation rectangular cross, when it leans and is equipped with the corresponding nozzle in two ink jet print heads here, it can equip with two ink jet print heads so that it may stand in a line in the carriage migration direction 15.

[0034] In addition, although the example which drives a nozzle downward from on in drawing was shown by the ink jet print head 11 in the example shown in drawing 4, moving carriage 12 to the left from the right among drawing, a nozzle may be driven upwards from under in drawing by the ink jet print head 11, making reverse move carriage 12 to the right from the left in drawing.

[0035] Drawing 5 is the explanatory view of whenever [setting-angle / of the ink jet print head in one gestalt of operation of the ink jet recording apparatus of this invention], and, an example of the printing control approach and a printing result. Here, the case where the ink jet print head of cyanogen (C) and a Magenta (M) as shown in drawing 3 (B), and 3 color one apparatus of yellow (Y) is used is shown. The nozzle of each 36 colors is used as the nozzle 6 for printing record as mentioned above. Here, only the nozzle 6 for printing record used for record is shown. Drawing 5 (A) explains the include angle when attaching an ink jet print head in carriage. Here, the printing block is divided into three for every color of cyanogen (C), a Magenta (M), and yellow (Y). And an ink jet print head is leaned and carriage is equipped so that only 63.5 micrometers may shift between each record color, one dot pitch, for example, 400dpi, of record resolution. For example, if the example shown in drawing 3 is used, it will be equipped with an ink jet print head so that spacing of the carriage migration direction of the nozzle of No. 7 which carries out the regurgitation of the ink of cyanogen (C), and the nozzle of No. 55 which carries out the regurgitation of the ink of a Magenta (M) may serve as one dot pitch. Similarly, spacing of the carriage migration direction of the nozzle of No. 55 which carries out the regurgitation of the ink of a Magenta (M), and the nozzle of No. 103 which carries out the regurgitation of the ink of yellow (Y) is also one dot pitch.

[0036] Carriage is equipped with an ink jet print head with an inclination as shown in drawing 5 (A), and moving carriage in the carriage migration direction 15 which carries out an abbreviation rectangular cross to the direction 16 of a form feed, as shown in drawing 4, an ink jet print head is driven and it

records on the record form 14. The regurgitation of the ink regurgitation sequence of each block here shall be carried out one by one from above as shown in drawing 5 (A). Moreover, the nozzle of the same regurgitation sequence of each block shall be driven simultaneously. By printing by such actuation approach, a printing result as shown in drawing 5 (B) can be obtained.

[0037] That is, after making ink breathe out in the carriage migration direction from the nozzle of 1 dot-pitch ***** of No. 7, No. 55, and No. 103, respectively, carriage moves in the carriage migration direction by 1 nozzle pitch, and the regurgitation of the ink is carried out from the nozzle of No. 8, No. 56, and No. 104. This actuation is performed until ink is breathed out from the nozzle of No. 42, No. 90, and No. 138, and one actuation actuation is completed. Then, as for a set and the dot train of each block, the dot of each block will shift [only one dot pitch] in the shape of a straight line. Thus, a printing result as shown in drawing 5 (B) is obtained. In addition, for example under the dot train of a block of cyanogen (C), spacing of only the part of a dummy nozzle is kept and the dot train of a Magenta (M) is printed in the case of the next actuation actuation. Furthermore, the dot train of yellow (Y) will be printed by the lower part by the next actuation actuation.

[0038] Thus, good linearity can be acquired in spite of carrying out sequential actuation of the inside of a block, carrying out simultaneous actuation of the dispersed nozzle. Moreover, since it is a gap of one dot pitch between blocks, what is necessary is just to transmit the data which shifted by 1 pixel as record image data, and the gap during a block is not generated on the printed image. For example, although good linearity can be acquired if sequential actuation of all the nozzles is carried out, it is necessary to perform 108 discharging by the above-mentioned ink jet print head in 1 time of actuation timing in that case. Since simultaneous actuation of the three nozzles is carried out, the count of discharging in 1 time of actuation timing can be managed with this example one third. Therefore, high-speed actuation is possible. Here, although the example which carries out simultaneous actuation of the three nozzles was shown, when performing high-speed record, printing speed can be easily accelerated by increasing the number of the nozzles which carry out the regurgitation simultaneously. When such, 6 nozzle coincidence or 9 nozzle simultaneous actuation is attained by enlarging the inclination of an ink jet print head further, or increasing from one the number of nozzles which carries out the regurgitation simultaneously within each block with 2 and 3. If the number of nozzles simultaneously driven within a block increases, linearity will worsen somewhat.

[0039] Drawing 6 is whenever [setting-angle / of the ink jet print head in one gestalt of operation of the ink jet recording apparatus of this invention], and, the explanatory view of another example of the actuation approach and a printing result. The mounting angle to the carriage of an ink jet print head is the same as that of above-mentioned drawing 5 (A), and between blocks, it is attached so that only one dot pitch may shift.

[0040] Here, regurgitation sequence within each block is interlace-ized further, and the further cross talk is reduced. In the case of actuation sequence as shown in above-mentioned drawing 5 , a cross talk may occur between the adjoining nozzles. Therefore, the nozzle which adjoins in [as possible] location is driven in sequence which actuation sequence does not approach.

[0041] Drawing 7 is the explanatory view of an example of the actuation sequence by interlace actuation. In this example, as 1-block 36 nozzles are divided into every 9 four subblocks and it is shown in drawing 7. by making a subblock into a unit, after driving the 1st nozzle, the 4th nozzle is driven and it drives hereafter in the 7th, the 2nd, the 5th, the 8th, the 3rd, the 6th, and the 9th order. Termination of

actuation of one subblock drives the nozzles from the 10th in the following subblock to the 18th. Henceforth, it drives to the 36th nozzle per subblock in the same sequence.

[0042] When such actuation is performed, if the ink jet print head is standing it still, a dot as shown in the left-hand side of drawing 7 by the round mark will be formed on a record form. However, since it records moving an ink jet print head, it becomes a dot train as shown in drawing 6 (B) as a printing result. This printing result will not be a straight line if it says strictly. Although it attaches and indicates that a level difference is intelligible by drawing 6 (B), the gap between each dot is about 2 micrometers actually, and cannot be judged as a visual level difference.

[0043] Moreover, what is necessary is just to increase the number of nozzles driven simultaneously, when [for the further improvement in the speed] the number of nozzles is made to increase by leaps and bounds. In this case, what is necessary is just to drive each above-mentioned subblock simultaneously, since the regurgitation of ink may become impossible normally under the effect of a cross talk if the regurgitation of many adjoining nozzles is carried out simultaneously.

[0044] Drawing 8 is the explanatory view of an example of the actuation sequence by the interlace actuation in a subblock in the case of carrying out simultaneous actuation of the subblock. In the example shown in drawing 8, 36 nozzles of 1 classification by color are divided into every 9 four subblocks, and interlace actuation of the inside of each subblock is carried out in the same actuation sequence as drawing 7. In this example, the nozzle of the same actuation sequence of each subblock is driven simultaneously. That is, interlace actuation will be performed in this block, carrying out simultaneous actuation of every four.

[0045] Moreover, each block performs simultaneous actuation. Since the number of simultaneous actuation nozzles within a block is made into four in this example, as the whole ink jet print head, 12 nozzles will be driven simultaneously. Therefore, the response to high-speed printing becomes possible very easily. For example, although considering the ink jet print head which has 144 nozzles per color 16 subblocks which consist of nine nozzles are made, every four subblock of this is made into a group, and actuation as shown in drawing 8 by four subblocks in a group is performed. And sequential actuation of each group is carried out. If such actuation is performed, 432 nozzles can be driven by 144 per color, and three colors with the clock same as actuation timing as the case where sequential actuation of the 36 nozzles is carried out. Thus, even if it forms many nozzles, it can print, without reducing printing speed, and if it is the same number of nozzles, it is printable at a high speed. However, if there is a nozzle by which simultaneous actuation is carried out between subblocks, linearity will worsen with the inclination of an ink jet print head. However, it does not get worse than the actual condition and the effectiveness of high-speed printing can be expected enough.

[0046] Each above-mentioned example showed the example which forms a block according to each color using the ink jet print head of 3 color one apparatus. However, this invention is not restricted to this and a block division is not limited according to a color. For example, it may divide into two or more blocks about each color, or you may divide for every predetermined number from an edge regardless of a color. Moreover, also in a monochromatic ink jet print head, a nozzle can be divided into a block for every predetermined number, and it can also print by the above actuation control. When using both a monochromatic ink jet print head and the ink jet print head of 3 color one apparatus, if the actuation approach same about both is applied, the control in a drive system etc. is easy. However, it is easy to be natural, even if it applies this invention only to either and applies other actuation control to another side.

[0047]

[Effect of the Invention] Since the nozzle made to breathe out simultaneously is dispersed to each block according to this invention so that clearly from the above explanation, the effect of an acoustical cross talk like a fluid can be reduced. Moreover, a printing frequency can be improved, without being able to end the sequential actuation in 1 time of printing timing with the small number of clocks, and degrading the linearity of an image, since the nozzle in the corresponding physical relationship made to breathe out simultaneously with an adjoining block constituted so that a dot might be formed in the location from which only 1 dot space of record resolution was separated to the scanning direction. For example, in case carriage is equipped with an ink jet print head, the above linearity and a printing frequency can be raised by leaning and arranging so that the distance of the nozzle to which each block corresponds may turn into distance which it is. Also when spacing which disperses a dot by sequential actuation when many nozzles are formed especially is extended, it is effective in the ability to suppress degradation of the linearity of an image to the minimum.

* NOTICES *

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline configuration perspective view showing an example of the ink jet print head used in one gestalt of operation of the ink jet recording apparatus of this invention.

[Drawing 2] It is the sectional view of the direction of passage of an example of an ink jet print head used in one gestalt of operation of the ink jet recording apparatus of this invention.

[Drawing 3] It is the front view showing the example of the ink jet print head used in one gestalt of operation of the ink jet recording apparatus of this invention.

[Drawing 4] It is the mimetic diagram showing an example of the wearing condition of the ink jet print head in one gestalt of operation of the ink jet recording apparatus of this invention.

[Drawing 5] It is the explanatory view of whenever [setting-angle / of the ink jet print head in one gestalt of operation of the ink jet recording apparatus of this invention], and, an example of the printing control approach and a printing result.

[Drawing 6] They are whenever [setting-angle / of the ink jet print head in one gestalt of operation of the ink jet recording apparatus of this invention], and, the explanatory view of another example of the

actuation approach and a printing result.

[Drawing 7] It is the explanatory view of an example of the actuation sequence by interlace actuation.

[Drawing 8] It is the explanatory view of an example of the actuation sequence by the interlace actuation in a subblock in the case of carrying out simultaneous actuation of the subblock.

[Drawing 9] It is the explanatory view of an example of the conventional actuation approach.

[Drawing 10] It is the explanatory view of an example of the actuation approach of the conventional interlace.

[Drawing 11] It is the explanatory view of the level difference at the time of driving interlace in the ink jet print head of two or more color one apparatus.

[Description of Notations]

1 -- channel substrate and 2 -- a heater substrate, 3 -- thick-film resin layer, 4 -- ink reservoir; and 5 -- a reservoir septum, the nozzle for 6 -- printing records, 7 -- dummy nozzle, and 8 -- spacing, 9 -- heating element, 11 -- ink jet pudding head, and 12 -- carriage, 13 -- carriage guide, 14 -- record forms, and 15 -- the carriage migration direction, the direction of 16 -- form feed, and 17 -- actuation control section.
